Informing Restoration Design and Management:

Findings to Date

Current Research Focus

- Processes that control the production and degradation of methylmercury (MeHg)
- Mercury (Hg) uptake and accumulation through food webs
- Sources and sinks of Hg and MeHg

Background: What is required to produce Methylmercury (MeHg)?

- Inorganic mercury available for methylation
- Bacteria that methylate mercury
- Saturated soils
- Organic matter
- Sulfate but low sulfide

Restoration Actions

e.g., levee breaching, dredging, sediment reuse, floodplain restoration, dam removal, stream re-alignment

Restoration Actions



Habitat Changes

e.g., changing sulfate (increasing salinity, inputting sulfate fertilizer);

changing hydrology (duration, depth, frequency of inundation);

changing redox (reducing or oxidizing conditions); changing vegetation patterns (plant biomass, production, community composition)

Restoration Actions



Habitat Changes



Mercury Cycling

Hg Availability for Methylation Microbial Activity Food Web dynamics

Restoration Actions



Habitat Changes



Mercury Cycling



Risk of Exposure

For any given habitat type, the direction and amount of change in mercury cycling depends on location within the watershed.

Nexus of Current Research and Restoration Actions

Habitat Changes
Sulfate, Redox, Vegetation, Hydrology



Mercury Cycling

Hg Availability for Methylation Microbial Activity Food Web dynamics

Changing Sulfate

In freshwater systems, increased sulfate may lead to increased sulfate reduction rates.

<u>Current Evidence</u>: Comparison of Sulfate reduction rates in Consumnes River, Frank's Tract, and Petaluma River

Management issues:

Increasing salinity
Increasing sulfate fertilizers

Changing Redox

Altering sediment redox affects microbial activity and mercury bioavailability (reoxidation of reduced sediments)

Current Evidence: Positive relationship between redox conditions and % reactive mercury (Marvin-DiPasquale)

Management Issue:

Dredging and dredged sediment reuse Altering vegetation patterns

Changing Vegetation

Changing vegetation may alter food web structure, microbial activity, mercury bioavailability, and DOM amount, quality and reactivity.

Current Evidence:

More microbial activity in SAV (MMD)

More mercury reactivity in EV (MMD)

More MeHg in pickleweed than in slough (MMD)

MeHg production correlated to EV density (Stephenson)

Management issues:

Plant community composition and structure

Changing Hydrology

Hydrology controls the methylation of mercury by transporting particulate matter and solutes (sulfate, DOM) and by regulating physio-chemical conditions (e.g. redox).

Current Evidence:

MeHg release is tightly coupled with tidal period (Bergamaschi & Fleck)

Benthic flux is linked with tidal cycles (Gill)

Management Issues:

Tidal prism and water depth Soil wet/dry cycles Water residence time

